
HD74ALVCH16270

12-bit to 24-bit Registered Bus Exchanger with 3-state Outputs

HITACHI

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Description

The HD74ALVCH16270 is used in applications where data must be transferred from a narrow high speed bus to a wide lower frequency bus. The device provides synchronous data exchange between the two ports. Data is stored in the internal registers on the low to high transition of the clock (CLK) input when the appropriate $\overline{\text{CLKEN}}$ inputs are low. The select ($\overline{\text{SEL}}$) line selects 1B or 2B data for the A outputs. For data transfer in the A to B direction, a two stage pipeline is provided in the A to 1B path, with a single storage register in the A to 2B path. Proper control of the $\overline{\text{CLKENA}}$ inputs allows two sequential 12-bit words to be presented synchronously as a 24-bit word on the B port. Data flow is controlled by the active low output enables ($\overline{\text{OEA}}$, $\overline{\text{OEB}}$). The control terminals are registered to synchronize the bus direction changes with CLK. Active bus hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

Features

- $V_{\text{CC}} = 2.3 \text{ V}$ to 3.6 V
- Typical V_{OL} ground bounce $< 0.8 \text{ V}$ ($@V_{\text{CC}} = 3.3 \text{ V}$, $T_a = 25^\circ\text{C}$)
- Typical V_{OH} undershoot $> 2.0 \text{ V}$ ($@V_{\text{CC}} = 3.3 \text{ V}$, $T_a = 25^\circ\text{C}$)
- High output current $\pm 24 \text{ mA}$ ($@V_{\text{CC}} = 3.0 \text{ V}$)
- Bus hold on data inputs eliminates the need for external pullup / pulldown resistors

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Function Table

Inputs			Outputs	
CLK	\overline{OEA}	\overline{OEB}	A	1B, 2B
↑	H	H	Z	Z
↑	H	L	Z	Active
↑	L	H	Active	Z
↑	L	L	Active	Active

Output enable

Inputs			Outputs		
$\overline{CLKENA1}$	$\overline{CLKENA2}$	CLK	A	1B	2B
L	H	↑	L	L ^{*2}	2B ₀ ^{*1}
L	H	↑	H	H ^{*2}	2B ₀ ^{*1}
L	L	↑	L	L ^{*2}	L
L	L	↑	H	H ^{*2}	H
H	L	↑	L	1B ₀ ^{*1}	L
H	L	↑	H	1B ₀ ^{*1}	H
H	H	X	X	1B ₀ ^{*1}	2B ₀ ^{*1}

A-to-B storage ($\overline{OEB} = L$)

Inputs						Output A
$\overline{CLKEN1B}$	$\overline{CLKEN2B}$	CLK	\overline{SEL}	1B	2B	
H	X	X	H	X	X	A ₀ ^{*1}
X	H	X	L	X	X	A ₀ ^{*1}
L	X	↑	H	L	X	L
L	X	↑	H	H	X	H
X	L	↑	L	X	L	L
X	L	↑	L	X	H	H

B-to-A storage ($\overline{OEA} = L$)

H : High level

L : Low level

X : Immaterial

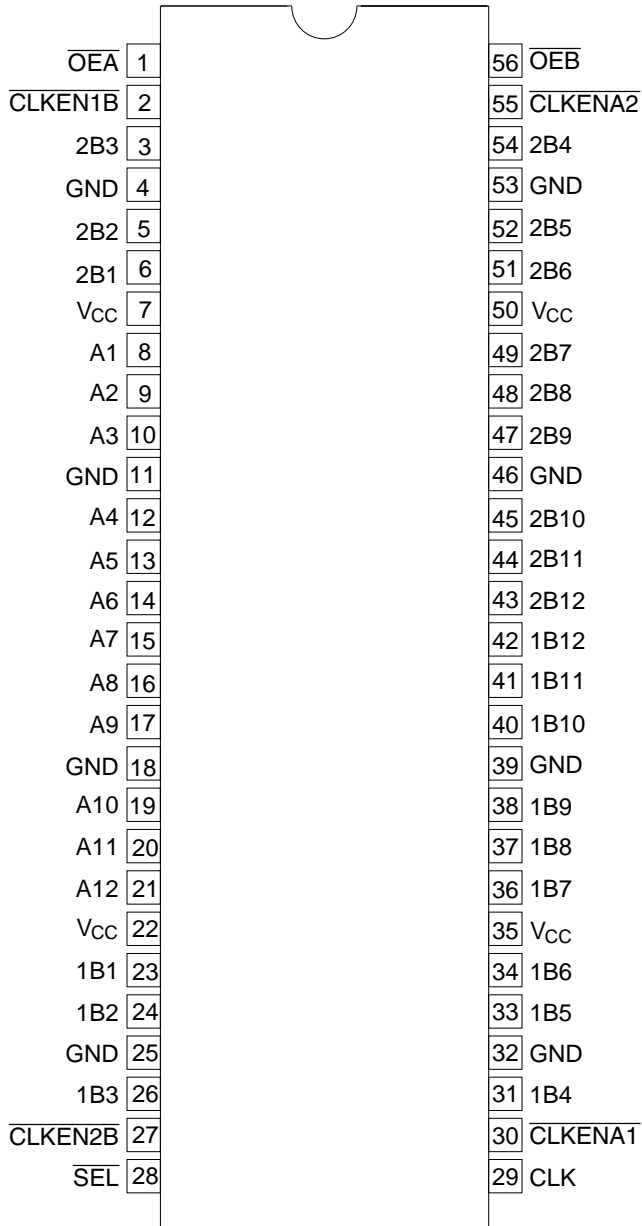
Z : High impedance

↑ : Low to high transition

Notes: 1. Output level before the indicated steady state input conditions were established.

2. Two CLK edges are needed to propagate data.

Pin Arrangement



(Top view)

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V_{CC}	-0.5 to 4.6	V	
Input voltage ^{*1,2}	V_I	-0.5 to 4.6 -0.5 to $V_{CC} + 0.5$	V	Except I/O ports I/O ports
Output voltage ^{*1,2}	V_O	-0.5 to $V_{CC} + 0.5$	V	
Input clamp current	I_{IK}	-50	mA	$V_I < 0$
Output clamp current	I_{OK}	±50	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	I_O	±50 ±100	mA	$V_O = 0$ to V_{CC}
Maximum power dissipation at $T_a = 55^\circ\text{C}$ (in still air) ^{*3}	P_T	1	W	TSSOP
Storage temperature	T_{stg}	-65 to 150	°C	

Notes: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

1. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
2. This value is limited to 4.6 V maximum.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage	V_{CC}	2.3	3.6	V	
Input voltage	V_I	0	V_{CC}	V	
Output voltage	V_O	0	V_{CC}	V	
High level output current	I_{OH}	—	-12	mA	$V_{CC} = 2.3\text{ V}$
		—	-12		$V_{CC} = 2.7\text{ V}$
		—	-24		$V_{CC} = 3.0\text{ V}$
Low level output current	I_{OL}	—	12	mA	$V_{CC} = 2.3\text{ V}$
		—	12		$V_{CC} = 2.7\text{ V}$
		—	24		$V_{CC} = 3.0\text{ V}$
Input transition rise or fall rate	$\Delta t / \Delta v$	0	10	ns / V	
Operating temperature	T_a	-40	85	°C	

Note: Unused control inputs must be held high or low to prevent them from floating.

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Electrical Characteristics (Ta = -40 to 85°C)

Item	Symbol	V _{CC} (V) ¹	Min	Max	Unit	Test Conditions				
Input voltage	V _{IH}	2.3 to 2.7	1.7	—	V					
		2.7 to 3.6	2.0	—						
	V _{IL}	2.3 to 2.7	—	0.7						
		2.7 to 3.6	—	0.8						
Output voltage	V _{OH}	Min to Max	V _{CC} -0.2	—	V	I _{OH} = -100 μA				
		2.3	2.0	—		I _{OH} = -6 mA, V _{IH} = 1.7 V				
		2.3	1.7	—		I _{OH} = -12 mA, V _{IH} = 1.7 V				
		2.7	2.2	—		I _{OH} = -12 mA, V _{IH} = 2.0 V				
		3.0	2.4	—		I _{OH} = -12 mA, V _{IH} = 2.0 V				
		3.0	2.0	—		I _{OH} = -24 mA, V _{IH} = 2.0 V				
	V _{OL}	Min to Max	—	0.2		I _{OL} = 100 μA				
		2.3	—	0.4		I _{OL} = 6 mA, V _{IL} = 0.7 V				
		2.3	—	0.7		I _{OL} = 12 mA, V _{IL} = 0.7 V				
		2.7	—	0.4		I _{OL} = 12 mA, V _{IL} = 0.8 V				
		3.0	—	0.55		I _{OL} = 24 mA, V _{IL} = 0.8 V				
		Input current	I _{IN}	3.6		—	±5	μA	V _{IN} = V _{CC} or GND	
				I _{IN (hold)}		2.3	45		—	V _{IN} = 0.7 V
						2.3	-45		—	V _{IN} = 1.7 V
3.0	75				—	V _{IN} = 0.8 V				
3.0	-75				—	V _{IN} = 2.0 V				
3.6	—				±500	V _{IN} = 0 to 3.6 V				
Off state output current ²	I _{OZ}	3.6	—	±10	μA	V _{OUT} = V _{CC} or GND				
Quiescent supply current	I _{CC}	3.6	—	40	μA	V _{IN} = V _{CC} or GND				
	ΔI _{CC}	3.0 to 3.6	—	750	μA	V _{IN} = one input at (V _{CC} -0.6) V, other inputs at V _{CC} or GND				

Notes: 1. For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

2. For I/O ports, the parameter I_{OZ} includes the input leakage current.

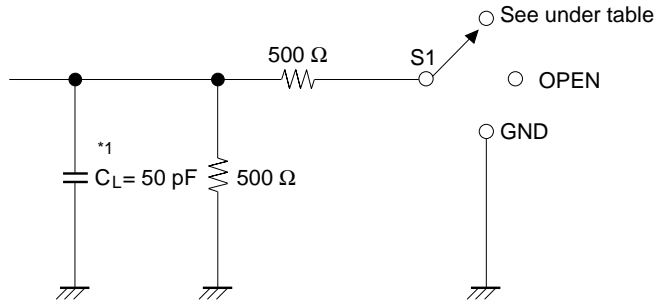
Switching Characteristics ($T_a = -40$ to 85°C)

Item	Symbol	V_{CC} (V)	Min	Typ	Max	Unit	FROM (Input)	TO (Output)
Maximum clock frequency	f_{max}	2.5±0.2	150	—	—	MHz		
		2.7	150	—	—			
		3.3±0.3	150	—	—			
Propagation delay time	t_{PLH}	2.5±0.2	2.0	—	6.5	ns	CLK	B
		2.7	—	—	5.8			
		3.3±0.3	1.1	—	5.1			
	t_{PHL}	2.5±0.2	1.7	—	6.0		CLK	A
		2.7	—	—	5.4			
		3.3±0.3	1.0	—	4.7			
		2.5±0.2	1.9	—	6.8		\overline{SEL}	A
		2.7	—	—	6.4			
		3.3±0.3	1.0	—	5.5			
Output enable time	t_{ZH}	2.5±0.2	1.6	—	7.5	ns	CLK	A or B
		2.7	—	—	6.8			
	t_{ZL}	3.3±0.3	1.0	—	6.0			
Output disable time	t_{HZ}	2.5±0.2	2.6	—	7.4	ns	CLK	A or B
		2.7	—	—	6.5			
	t_{LZ}	3.3±0.3	1.1	—	5.8			
Input capacitance	C_{IN}	3.3	—	3.5	—	pF	Control inputs	
Output capacitance	$C_{IN/O}$	3.3	—	9.0	—	pF	A or B ports	

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Item	Symbol	V _{cc} (V)	Min	Typ	Max	Unit	FROM (Input)
Setup time	t _{su}	2.5±0.2	4.1	—	—	ns	A data before CLK↑
		2.7	3.8	—	—		
		3.3±0.3	3.1	—	—		
		2.5±0.2	0.9	—	—		B data before CLK↑
		2.7	1.2	—	—		
		3.3±0.3	0.9	—	—		
		2.5±0.2	3.5	—	—		CLKENA1 or CLKENA2 before CLK↑
		2.7	3.2	—	—		
		3.3±0.3	2.7	—	—		
		2.5±0.2	3.4	—	—		CLKEN1B or CLKEN2B before CLK↑
		2.7	3.0	—	—		
		3.3±0.3	2.6	—	—		
		2.5±0.2	4.4	—	—		OE before CLK↑
		2.7	3.9	—	—		
		3.3±0.3	3.2	—	—		
Hold time	t _h	2.5±0.2	0	—	—	ns	A data after CLK↑
		2.7	0	—	—		
		3.3±0.3	0.2	—	—		
		2.5±0.2	1.4	—	—		B data after CLK↑
		2.7	1.0	—	—		
		3.3±0.3	1.7	—	—		
		2.5±0.2	0	—	—		CLKENA1 or CLKENA2 after CLK↑
		2.7	0.1	—	—		
		3.3±0.3	0.3	—	—		
		2.5±0.2	0	—	—		CLKEN1B or CLKEN2B after CLK↑
		2.7	0	—	—		
		3.3±0.3	0.6	—	—		
		2.5±0.2	0	—	—		OE after CLK↑
		2.7	0	—	—		
		3.3±0.3	0.1	—	—		
Pulse width	t _w	2.5±0.2	3.3	—	—	ns	CLK "H" or "L"
		2.7	3.3	—	—		
		3.3±0.3	3.3	—	—		

• Test Circuit



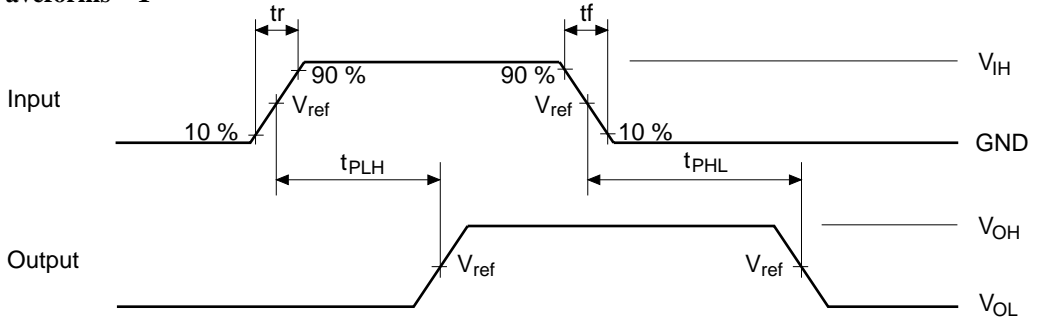
Load Circuit for Outputs

Symbol	V _{CC} =2.5±0.2V	V _{CC} =2.7V, 3.3±0.3V
t _{PLH} /t _{PHL}	OPEN	OPEN
t _{su} /t _h /t _w	OPEN	OPEN
t _{ZH} /t _{HZ}	GND	GND
t _{ZL} /t _{LZ}	4.6 V	6.0 V

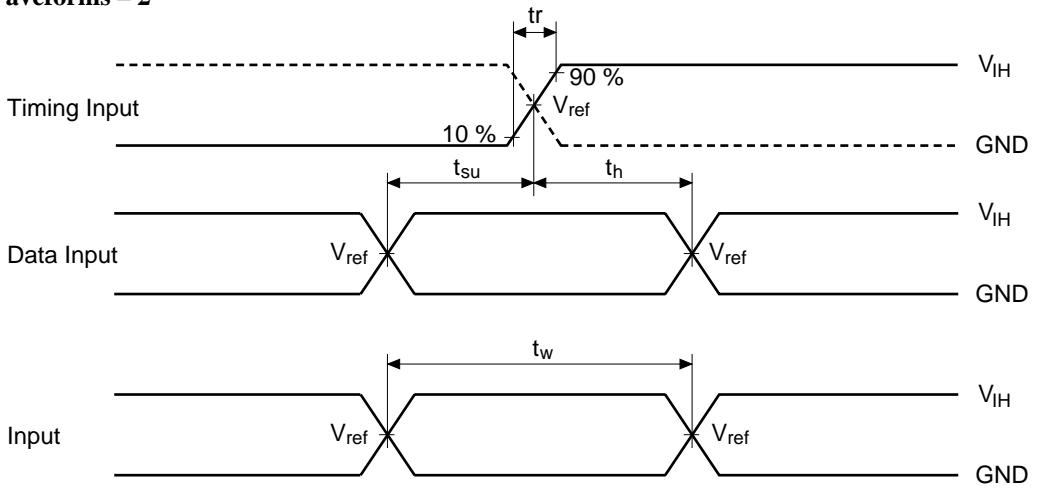
Note: 1. C_L includes probe and jig capacitance.

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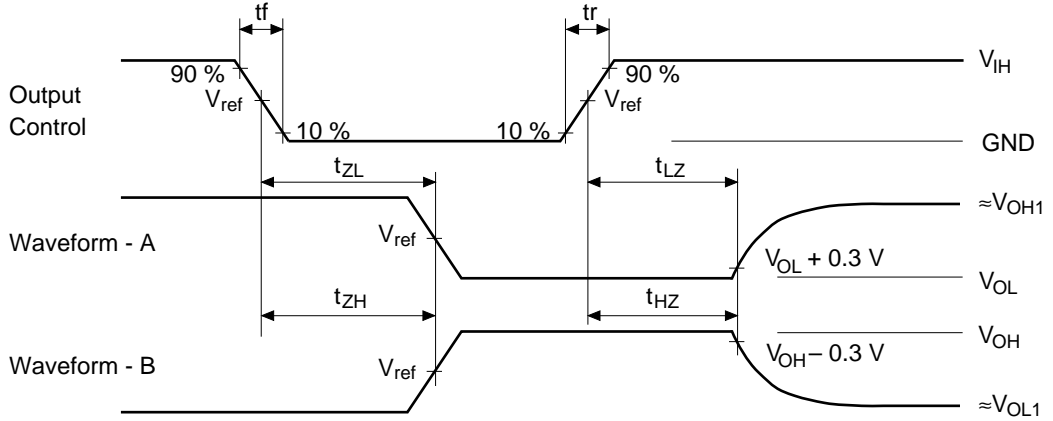
• Waveforms – 1



• Waveforms – 2



• Waveforms – 3



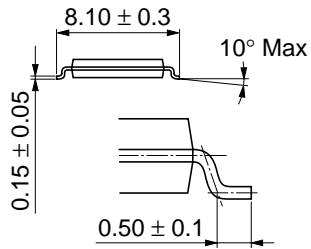
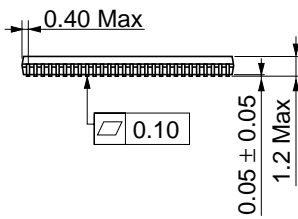
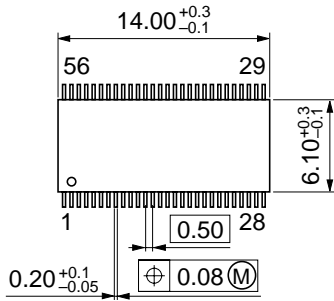
TEST	$V_{CC}=2.5\pm 0.2V$	$V_{CC}=2.7V, 3.3\pm 0.3V$
V_{IH}	2.3 V	2.7 V
V_{ref}	1.2 V	1.5 V
V_{OH1}	2.3 V	3.0 V
V_{OL1}	GND	GND

- Notes:
1. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10$ MHz, $Z_o = 50 \Omega$, $t_r \leq 2.5$ ns, $t_f \leq 2.5$ ns.
 2. Waveform – A is for an output with internal conditions such that the output is low except when disabled by the output control.
 3. Waveform – B is for an output with internal conditions such that the output is high except when disabled by the output control.
 4. The output are measured one at a time with one transition per measurement.

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Package Dimensions

Unit : mm



Hitachi code	TTP-56D
EIAJ code	—
JEDEC code	—

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Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose, CA 95134
Tel: <1> (408) 433-1990
Fax: <1> (408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building, No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX

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